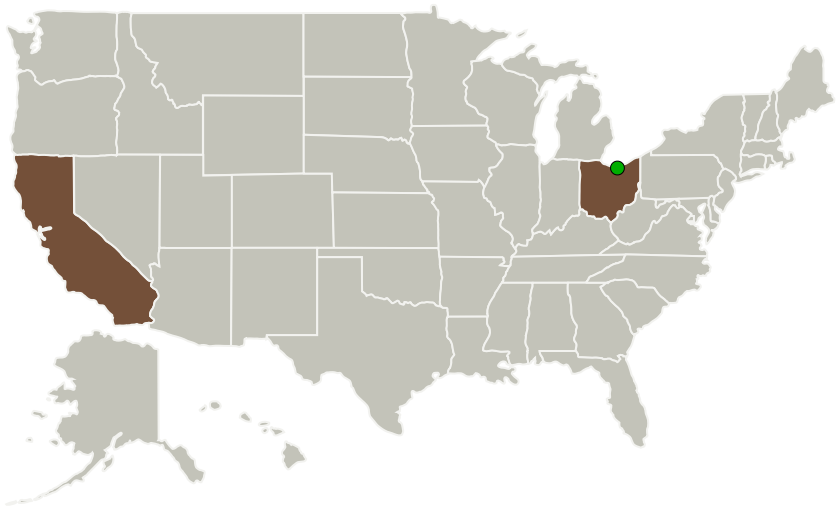
Low-Cost, High-Performance Combustion Chamber for LOX/CH4 Propulsion, Phase II

Completed Technology Project (2011 - 2014)

Project Introduction

In this project, Ultramet is designing and fabricating a lightweight, high temperature combustion chamber for use with cryogenic liquid oxygen/methane (LOX/CH4) propellant that will deliver a specific impulse of ~355 seconds, an increase over the current 320-sec baseline that will result in a propellant mass decrease of 55 lbm. The material system is based on Ultramet's proven oxide-iridium/rhenium architecture, which has been successfully hot-fire tested with stoichiometric oxygen/hydrogen for hours. Instead of rhenium, however, the structural material will be a niobium or tantalum alloy that has excellent yield strength at both ambient and elevated temperature. Phase I demonstrated alloys with yield strength-to-weight ratios more than three times that of rhenium, which will significantly reduce chamber weight. The starting materials are also two orders of magnitude less expensive than rhenium and are less expensive than the C103 niobium alloy commonly used in low-performance engines. Phase II will focus on the design, fabrication, and hot-fire testing of a small (5-25 lbf thrust class) chamber with LOX/CH4, and will culminate in the design and fabrication of a 100-lbf chamber that can be mated and tested with an existing LOX/CH4 injector. Throughout the project, Ultramet will work closely with Aerojet, which will perform the hot-fire testing.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Ultramet	Lead Organization	Industry	Pacoima, California
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
California	Ohio

Project Transitions

June 2011: Project Start

March 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139184)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Ultramet

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

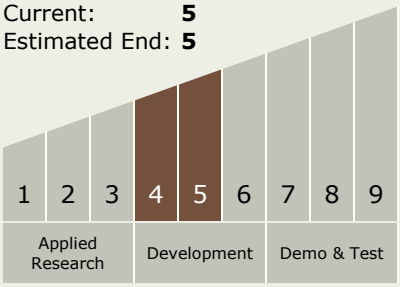
Carlos Torrez

Principal Investigator:

Arthur J Fortini

Technology Maturity (TRL)

Start: **4**
Current: **5**
Estimated End: **5**



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Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.1 Chemical Space Propulsion
    - TX01.1.3 Cryogenic

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System